Nov. 1, 1949 J. E. WHITFIELD 2,486,770

ARC GENERATED THREAD FORM FOR HELICAL ROTARY MEMBERS

Filed Aug. 21, 1946 6 Sheets-Sheet 6

Fig. 18

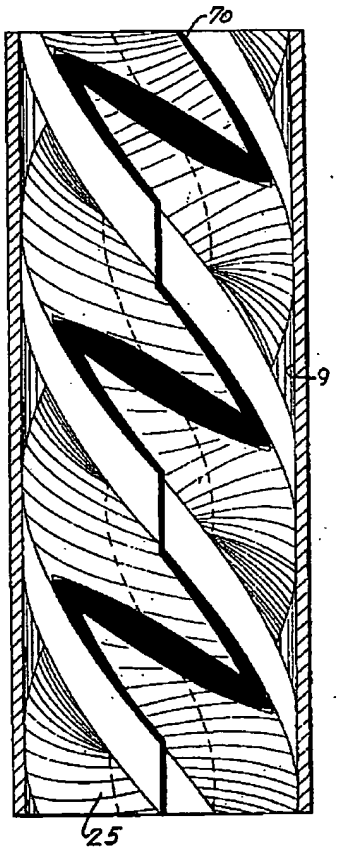
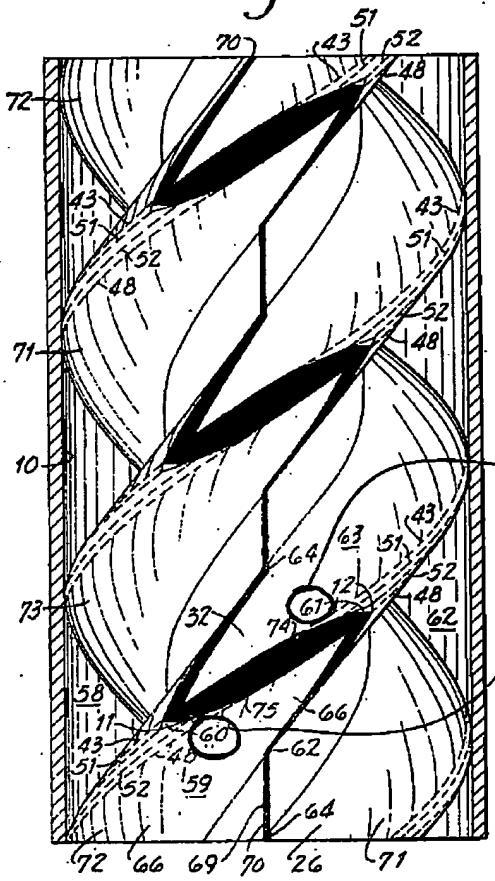


Fig. 19



"blow holes at the cusps (intersection 11 & 12)

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ARC GENERATED THREAD FORM FOR HELICAL ROTARY MEMBERS

Filed Aug. 21, 1946 6 Sheets-Sheet 1

Fig. 1

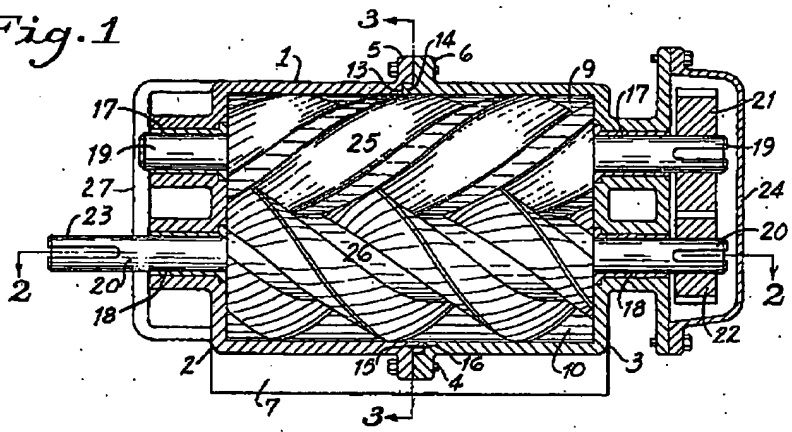


Fig. 2

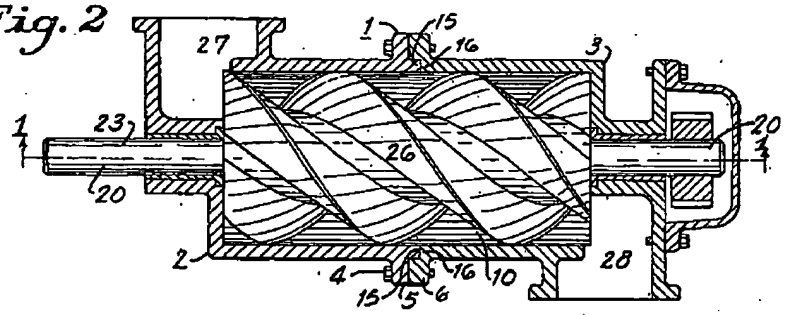
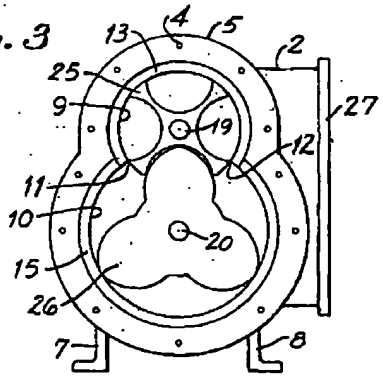


Fig. 3



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gate trough. The cutting point thus shifts along these arcuate surfaces 44 and 49. The normal point generated crest edge of the rotor is a point but when formed by arcs 44 and 49 an improved surface results. Thus arc generation of the surfaces of the rotary members provides an improved structure that can be made within closer shop tolerances and provides a superior sealing between the members.

The perimetral surface of the crests of the gate threads may be employed in the shape of the cutting tool to form the bottom 69 of the rotor threads. If the gate threads are greater in diameter than the gate pitch circle this perimetral surface of the gate threads will slide as well as roll over the bottoms 69 of the rotor troughs.

The continuous sealing band between the rotary members is shown on these members in Figs. 18 and 19. These rotary members 25 and 26 are extended in length to provide a better understanding of this continuous sealing band 70. It will be noted that the dimensions of the sealing band 70 are the same on both the gate and the rotor. They are in fact the same band when the figure of the gate is raised and turned face down on the figure of the rotor. This band 70 thus represents the extent of the sealing zone for a given fluid in any transverse plane of the members along their length. The width of the band 70 changes along its length because the curvatures of the mating surfaces of the rotary members change, as previously described, but the pattern is repeated and is similar to the seal line of a point generated thread structure.

Starting from the bottom of Fig. 19 the seal line 70 commences at the base 64 of the rotor lobe 71 and travels across the bottom 69 of the rotor trough to the base 62 of the flank 66 of the rotor lobe 72 and then proceeds up the flank getting wider as it progresses to the crest end 48 of the flank 66. The far side of the seal band then follows a transverse plane toward the center of the rotor to the line 61 and deviates to the point 74 on the line 43. The near side of the band at this time traces back along the line 49 to the point 75. The line 74, 75 represents diagonal "contact" line of a point generated thread form when the rotor lobe is in full mesh position. The seal band proceeds from point 76 diagonally to line 52 and then follows a transverse plane to the line 43 where the gate thread leaves the crest of the rotor thread and passes down the flank 32 to the base thereof as indicated at 64, the sealing band becoming narrower toward the base 64. This completes one full cycle of the sealing band which is repeated over each of the rotor lobes 71, 72 and 73.

The leakage paths 60 and 61 are indicated respectively by the small triangular spaces at the remote ends of the seal band and the apex of these triangles represent the relative positions of the intersections 11 and 12. The depth of these leakage paths 60 and 61 is less than the extent of the breadth of the triangles shown and the crests of the rotor and gate threads seal with the walls of their respective cylindrical chambers 9 and 10 between the points 11 and 12 or around the back of the chambers as viewed in Figs. 18 and 19.

When the device is used as a compressor it is better that the crest edges of the rotary members wipe the discharge port edges, that is, the crest edges gradually open under the discharge port edges in place of suddenly opening the pocket for the full extent of the crest edges.

When a liquid is being employed whether the device is used as a pump or motor, the discharge port lines should open the pocket before the pocket reduces its volume on a solid liquid. However if the device is designed to carry an air space in each pocket with a given amount of liquid then the volume of the pocket can be reduced until the air or gas is compressed to within safe pressures before opening the pocket to discharge.

If the device is to be used as a reversible blower or pump then the outlet and the inlet ports should match one another to provide the same characteristics when operated in either direction and when pumping a liquid the pockets should be opened to discharge at the same instant that they are closed to the intake.

The term "arcuate" as employed in the specification and claims, defines the continuous crest edges of the rotary members that are formed by the line connecting the sides or flanks of the threads with the perimetral surface of the threads, the latter being a circular arc struck from the axis of the members. This "arcuate" line when traced in a plane transversely of the axis of the member may be a portion of any character of mathematical curve such as a circle, a parabola, a spiral and the like, or an arc that has a progressively changing curvature wherein the curvature increases as it approaches the perimetral surface of the thread and does not necessarily follow a mathematical formula. It is of course important that the ends of this arcuate crest edge smoothly meld into the surfaces that they join.

When the "arcuate" crest edge of the thread of one member is employed to generate the flank or side of the thread of the other member it machines or cuts over its full arcuate extent by constantly changing the cutting point progressively around the arcuate crest edge.

In generating the rotor flank from the crest to the root the final point of generation on the arcuate crest edge surface of the gate affecting the shape of the rotor thread thus may be within or on the pitch circle of the gate but never beyond it without undercutting the rotor at the root of the thread resulting in a leakage path through the seal line between the rotary members. However any portion of the arcuate crest edge of the gate thread beyond the final point of generation and outside diameter of the gate may be said to form the root and hub of the rotor but it is ineffectual in shaping the generated portion of the rotor thread flank and will produce a continuous seal line between the rotary members. Thus a portion of the arcuate crest edges of the gate may be beyond its pitch circle or wholly within its pitch circle.

Thus the sides of the threads of the rotor are generated by a constantly changing point on the arcuate crest edge of the gate. The connecting fillet between the flanks and the hub of the rotor are formed by the remaining portion of the arcuate crest edges of the gate beyond its pitch circle. Correspondingly, the sides of the gate trough are generated by a constantly changing point on the arcuate crest edges of the rotor and the arcuate crest edges of the gate may be formed by the connecting fillet between the generated sides of the rotor thread and the cylindrical hub portion.

I claim:

1. Rotary elements for use in a ported housing of an axial flow fluid device, comprising rotor